FIG. 1A
(PRIOR ART)

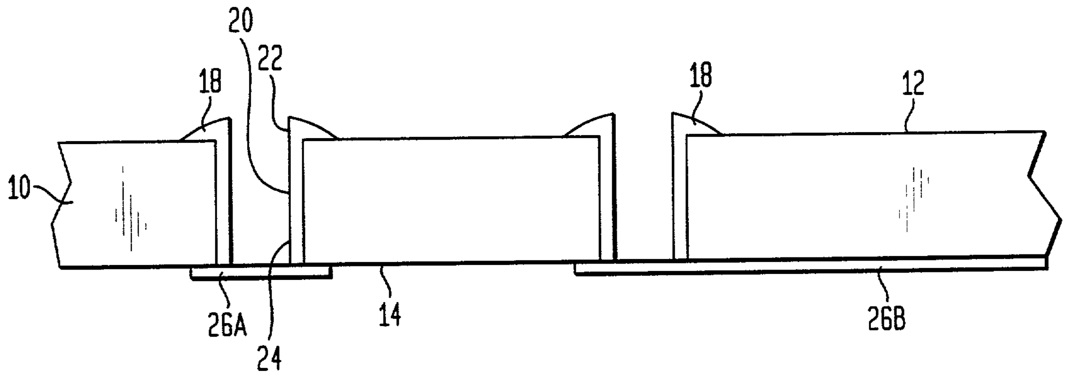
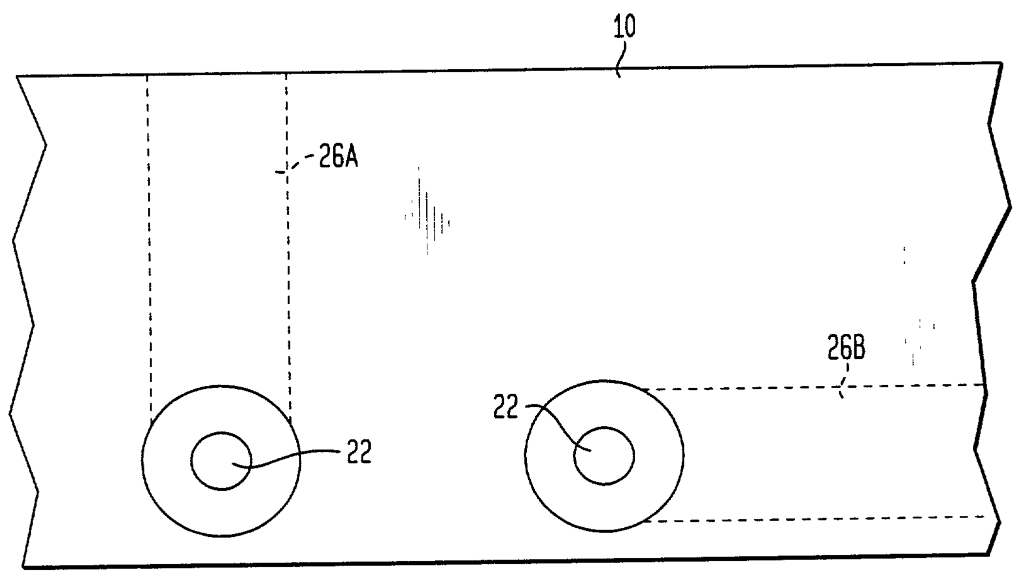


FIG. 1A-1
(PRIOR ART)



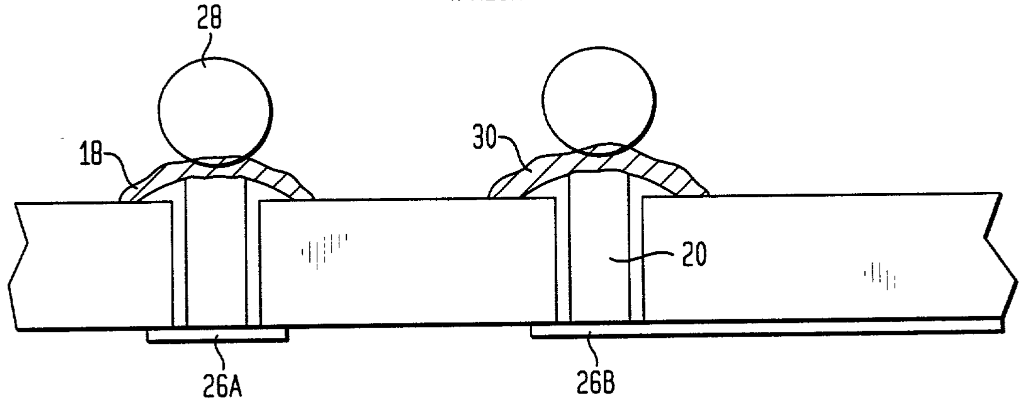


FIG. 1B
(PRIOR ART)

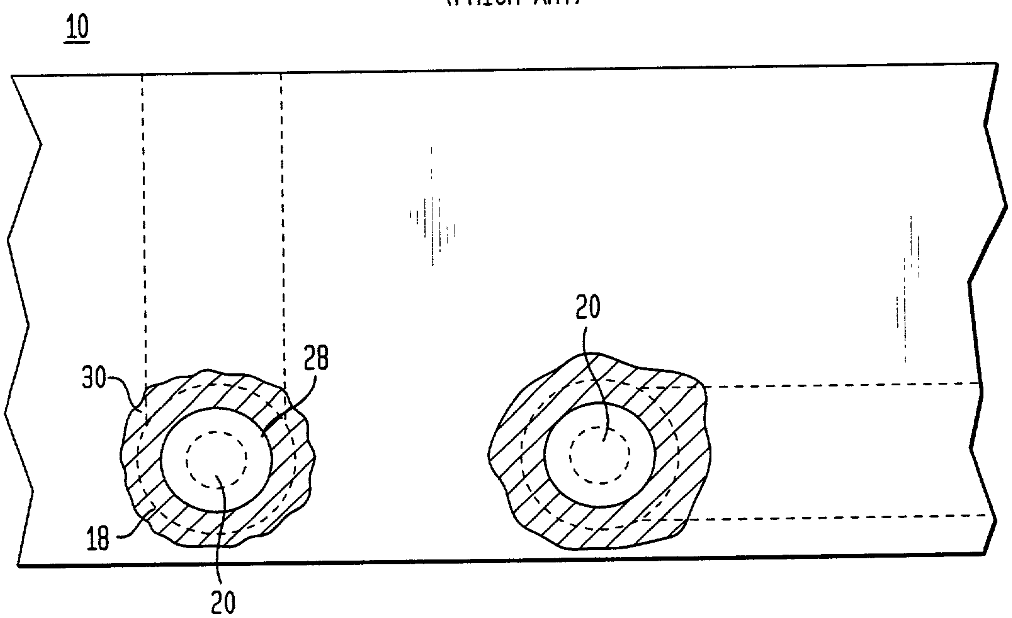


FIG. 1B-1
(PRIOR ART)

FIG. 1C
(PRIOR ART)

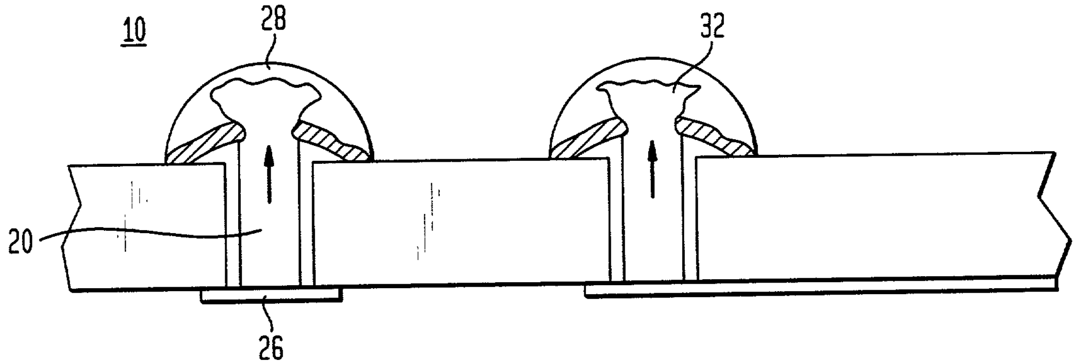


FIG. 1D
(PRIOR ART)

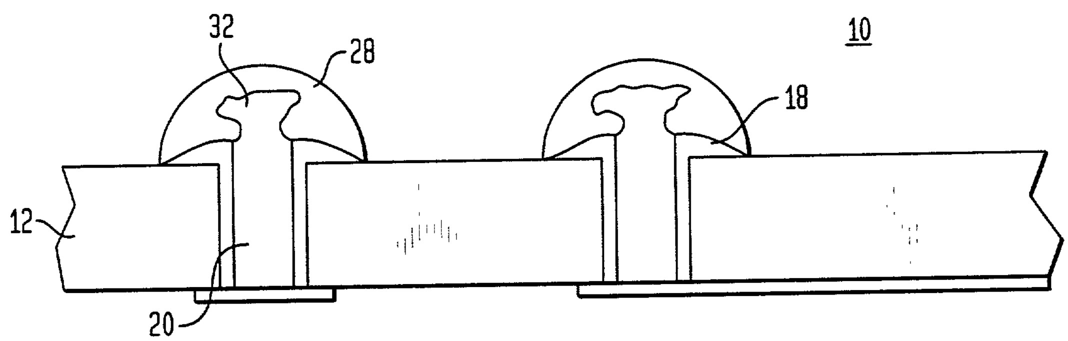


FIG. 2A

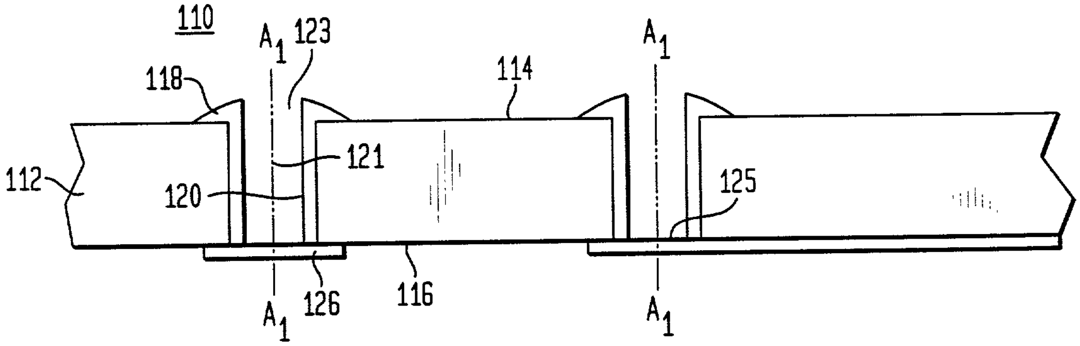


FIG. 2A-1

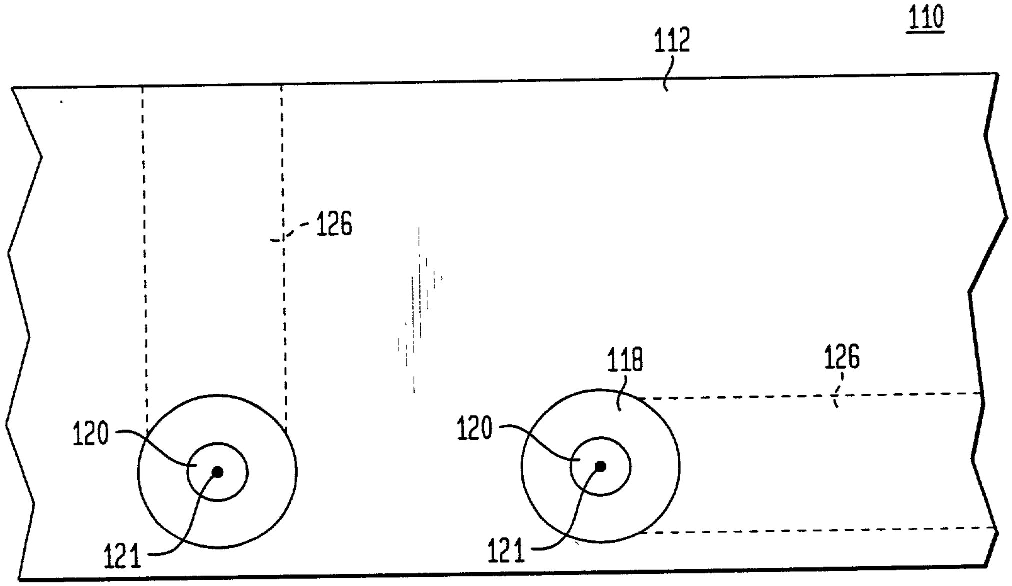


FIG. 2B

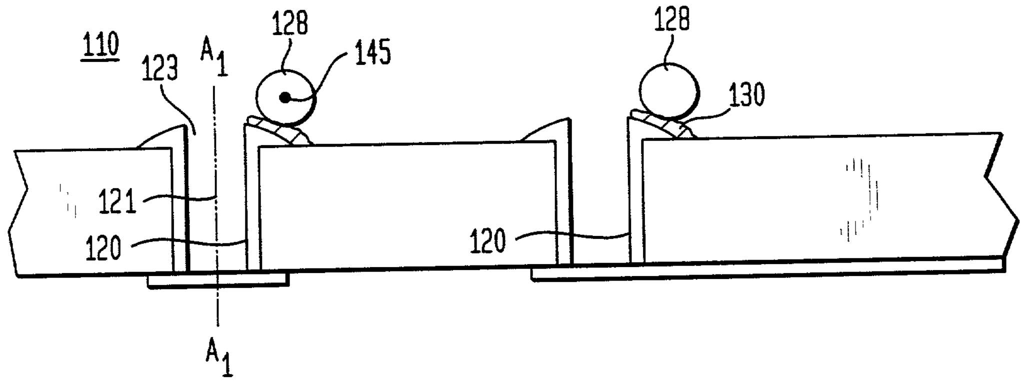

110
123
A_1
128
145
128
130
121
120
120
A_1

FIG. 2C

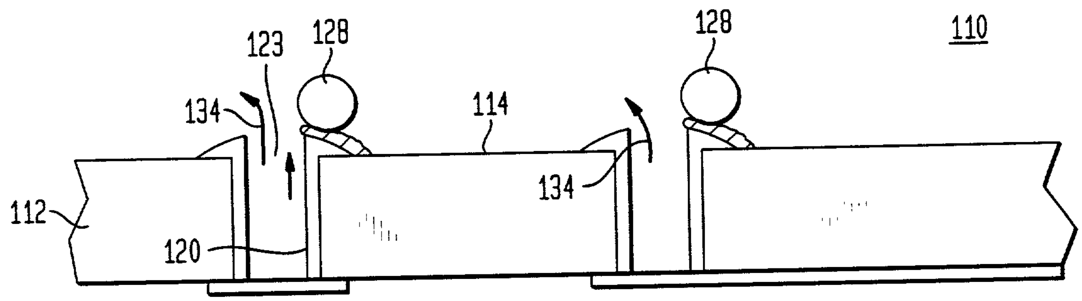

123
128
128
110
134
114
134
112
120

FIG. 2D

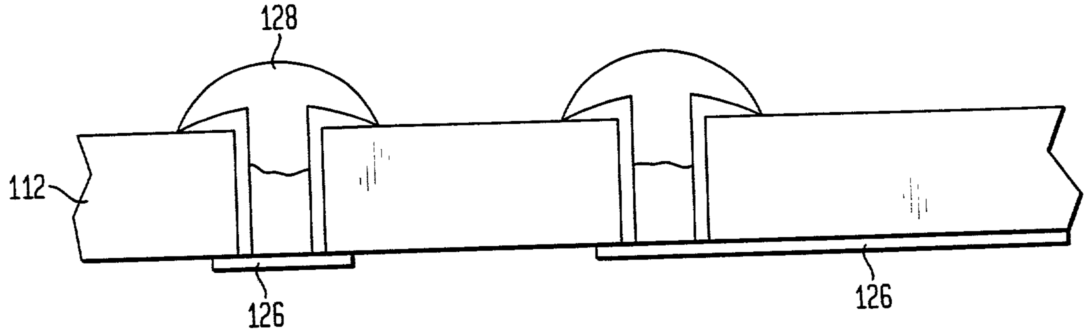


FIG. 2E

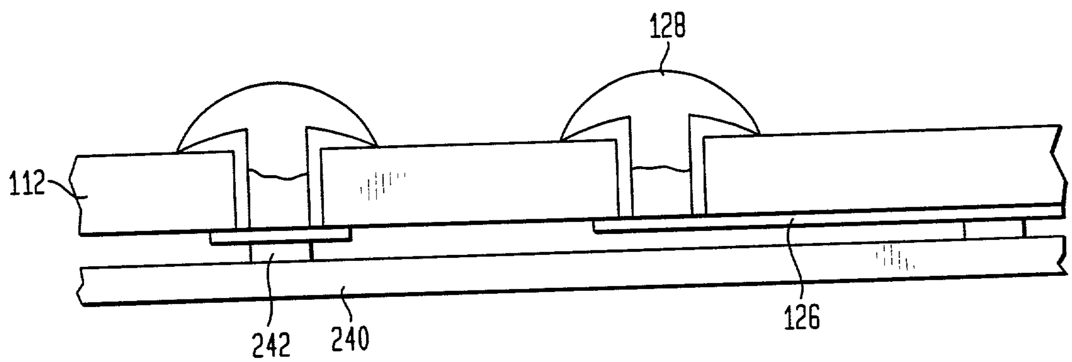


FIG. 2F

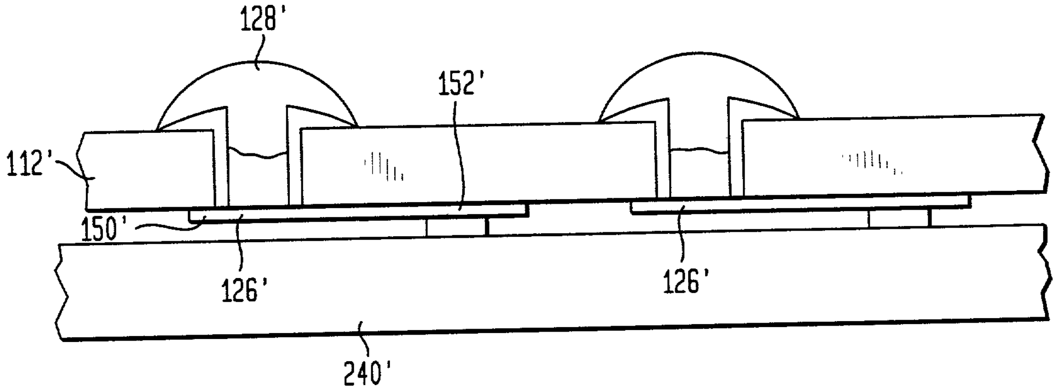


FIG. 2G

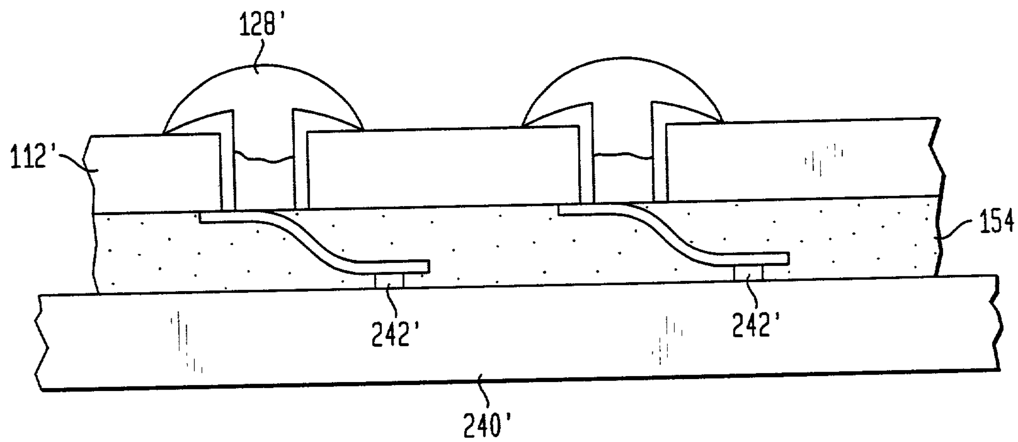


FIG. 3A

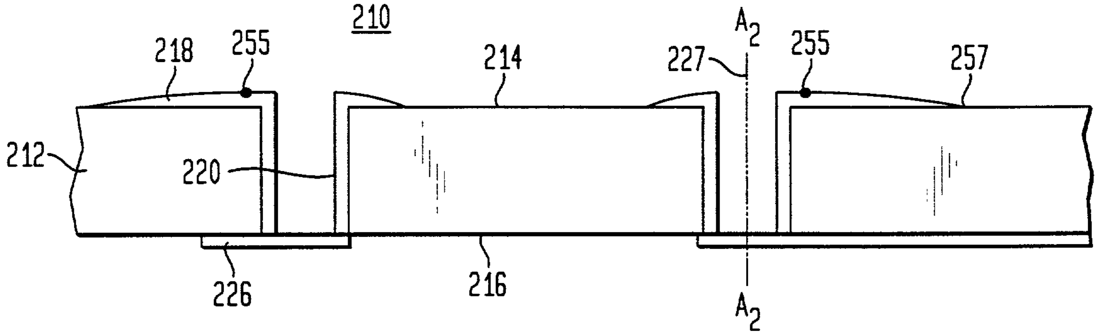


FIG. 3A-1

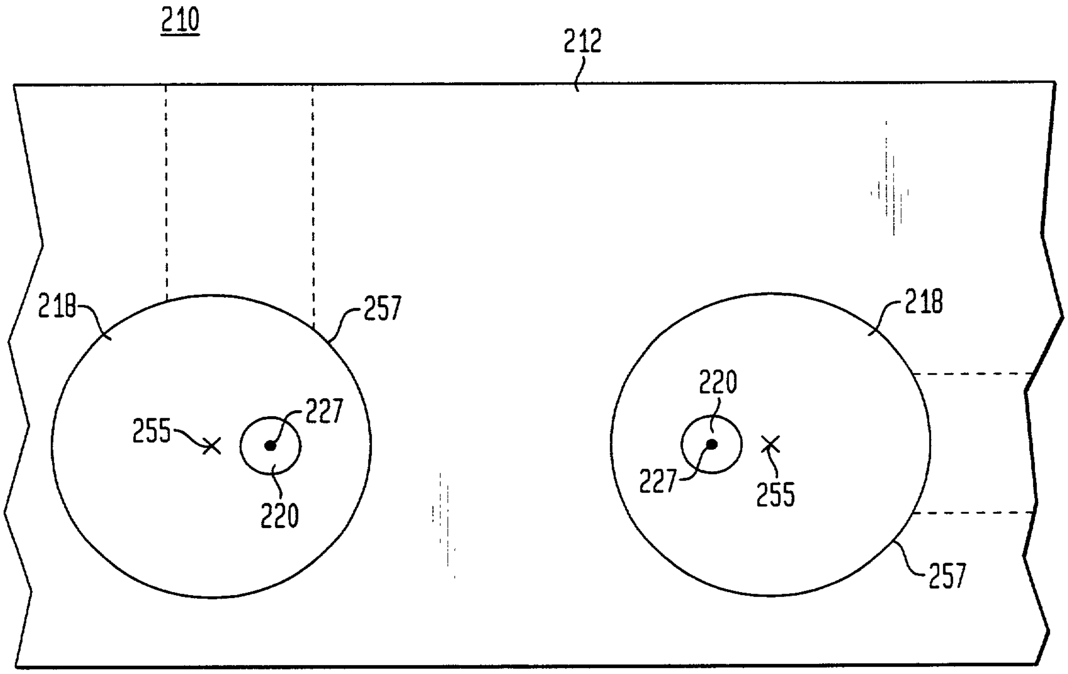


FIG. 3B

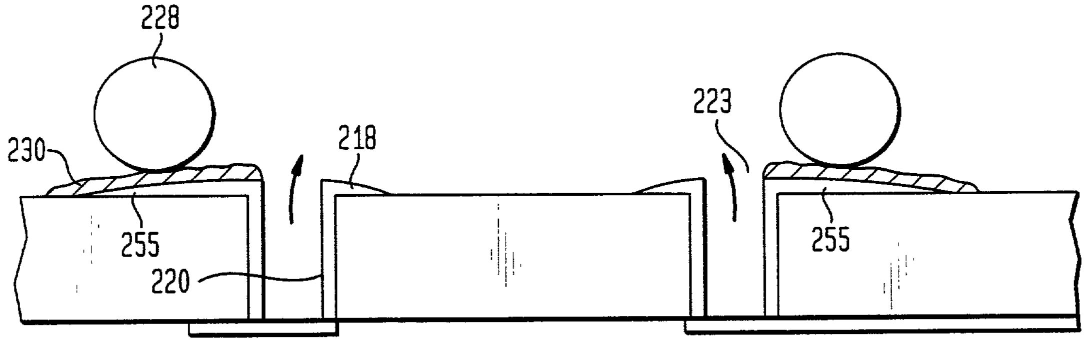


FIG. 3B-1

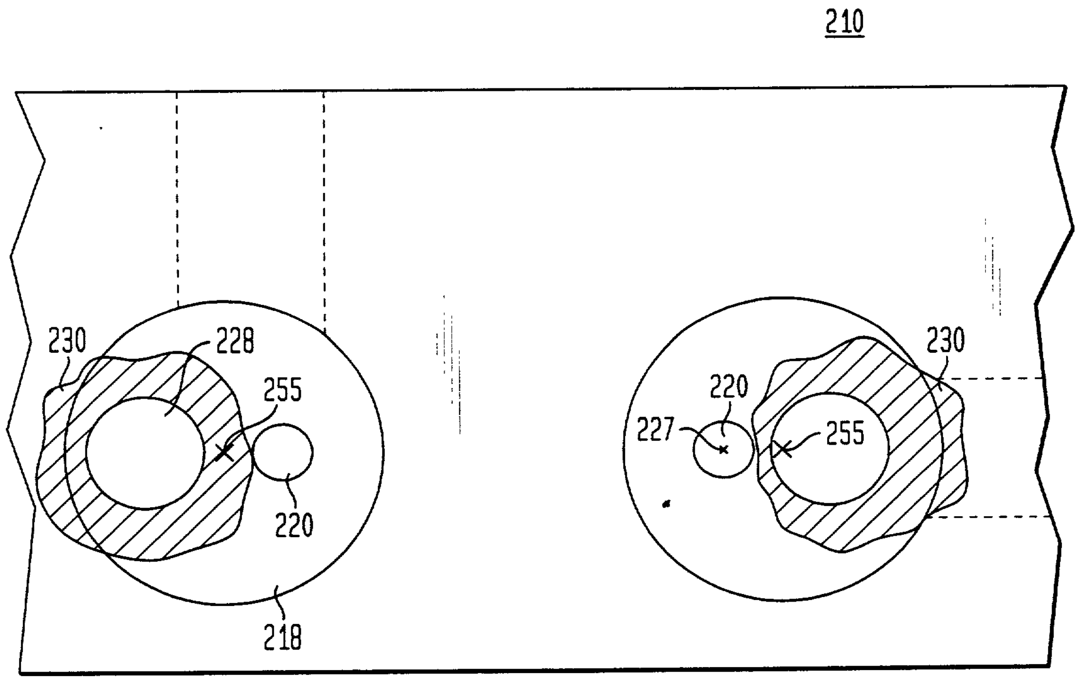


FIG. 3C

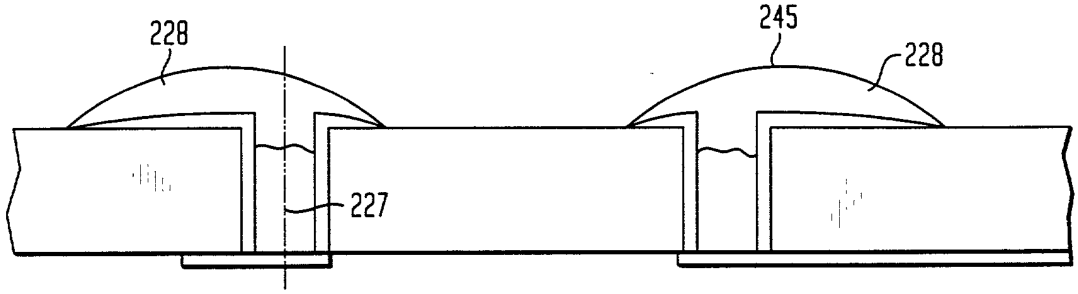


FIG. 3C-1

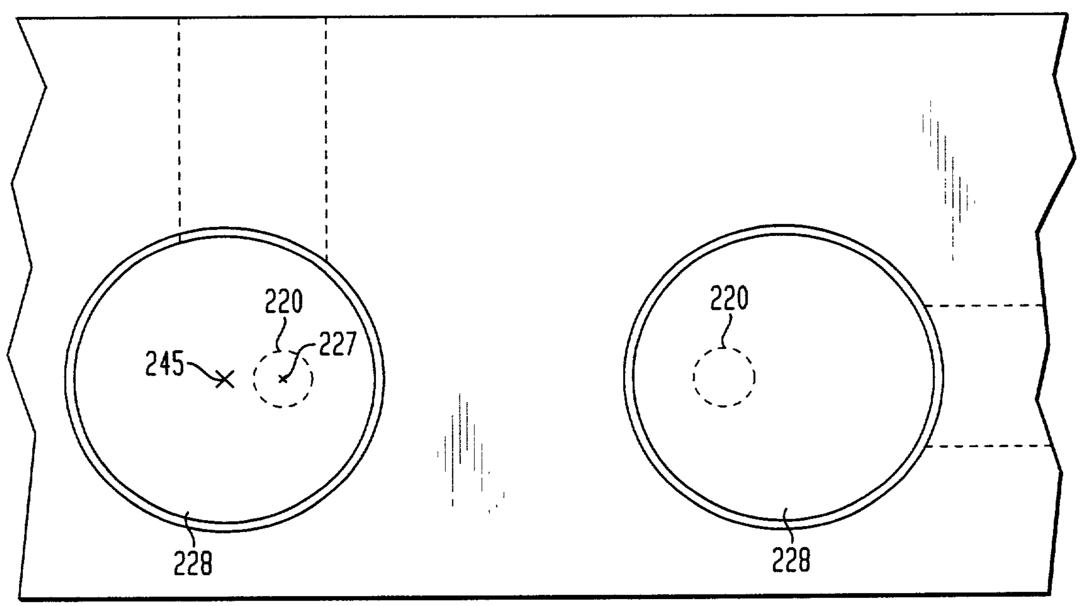


FIG. 4

SPLIT (1 STRIP)	FLUX	BALL PLACEMENT	POST-FLUX BAKE	PEAK TEMP (degC)	DWELL (SEC/ZONE)	VOIDS*	AVERAGE SIZE**	COMMENTS:
1	STANDARD	STANDARD	NONE	195	20	107	=	CONTROL LEG (STANDARD PROCESS)
2	STANDARD	STANDARD	5MIN@75C	220	55	~40	=	SOME IMPROVEMENT BUT VOIDS STILL FREQUENT
3	STANDARD	STANDARD	10MIN@100C	235	60	~40	>	EXTREMELY LARGE VOIDS
4	STANDARD	STANDARD	NONE	225	60	>40	=	SIMILAR TO RESULTS FROM LEG 2
5	STANDARD	STANDARD	5MIN@100C	225	60	>40	=	SIMILAR TO RESULTS FROM LEG 2
6	STANDARD	STANDARD	NONE	220	55	33	=	SIMILAR TO RESULTS FROM LEG 2
7	STANDARD	STANDARD	60MIN@100C	210	50	30	<	SIMILAR TO RESULTS FROM LEG 2
8	STANDARD	STANDARD	NONE	230	60	49	>	EXTREMELY LARGE VOIDS
9	STANDARD	STANDARD	NONE	210	50	49	=	LOWER PEAK TEMP RESULTS IN SMALLER VOIDS
10	PASTE	STANDARD	5MIN@120C	210	50	104	=	VOIDS SLIGHLTY REDUCED IN SIZE
11	PASTE	STANDARD	NONE	210	50	19	<	FLUX QTY INCONSISTANT OVER PRINT AREA
12	PASTE FILL	STANDARD	NONE	210	60	67	=	CUP-SHAPE REMAINS AT TOP OF VIA
13	OFF-CENTER	OFF-CENTER	NONE	225	60	7	<	SIGNIFICANT REDUCTION IN VOID SIZE AND FREQUENCY
14	OFF-CENTER	OFF-CENTER	NONE	195	20	25	<	FREQUENCY SIGNIFICANTLY IMPACTED BY REFLOW PROFILE
15	OFF-CENTER	OFF-CENTER	NONE	225	60	101	=	BALLS APPARENTLY ENTRAP AIR/FLUX
16	OFF-CENTER	OFF-CENTER	NONE	225	60	6	<	CONFIRMATION RUN (REPEAT OF 13)
17	OFF-CENTER	OFF-CENTER	NONE	225	60	8	<	CONFIRMATION RUN (REPEAT OF 13)

NOTES:

1. ALL PARTS PREBAKED 30MIN@150C PRIOR TO FLUX, PLACE, AND REFLOW
2. * - NUMBER OF BALL LOCATIONS EXHIBITING VISIBLE VOIDS UNDER X-RAY INSPECTION (OUT OF 188 TOTAL ON PART)
3. ** - AVERAGE SIZE OF VOIDS RELATIVE TO VIA DIAMETER (VIA DIAMETER = 5MILS; OVERALL PAD IS 12MILS DIAMETER)
4. TV 188 UNITS PROCESSED WITH OFF-CENTER BALL ATTACH (13, 16, 17) MAINTAINED LOW-LEVEL OF VOIDING THROUGH BOARD-LEVEL ASSEMBLY
   *BOARD MOUNT PERFORMED USING STANDARD PROFILE ON VITRONICS CONVECTION FURNACE (230C PEAK, 7 MIN PROFILE)